EASTMOUNT ENVIRONMENTAL SERVICES
Air Quality Specialists

FINAL REPORT

VOC and VOC HAP Emissions Testing from Residual Oil Tank No. 3 Tank Headspace and Loading Operations at Sprague's Searsport, Maine Terminal

Prepared for . . .

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1.0 INTRODUCTION

1.1 General

Eastmount Environmental Services, LLC of Newburyport, MA was retained by Sprague Operating Resources LLC of Portsmouth, NH to conduct emissions testing at their Searsport, Maine terminal. Testing was conducted to establish the emission rate of volatile organic compounds (VOC) and VOC hazardous air pollutants (VOC HAP) from the headspace emissions of Residual Oil (or No. 6 oil) Storage Tank No. 3, as well as emissions from storage tank and tanker truck loading operations

Testing was conducted in response to an EPA testing order for information under Section 114 of the Clean Air Act which was received by Sprague on September 27, 2011 and in accordance with testing approaches subsequently prescribed by USEPA Region I staff.

Testing on the Residual Oil Storage Tank No. 3 commenced on June 13, 2012, and was concluded on July 13, 2012. Headspace VOC emissions were measured continuously throughout this period. The Vessel Transfer Test occurred on June 20, 2012. The Loading Rack Test, during which ten tanker truckers were loaded with No. 6 fuel oil, occurred on July 31, 2012.

Please note that, for the purposes of this program, volatile organic compounds (VOC) are also referred as non-methane hydrocarbons (NMHC). NMHC are determined by measuring total hydrocarbons (in terms of propane) using EPA Method 25A, and methane using EPA Method 18 concurrently. Methane lb/hr emissions are subtracted from the total hydrocarbon lb/hr emissions to obtain NMHC lb/hr emissions. This is not to be confused with VOC HAP which are individual (rather than total) volatile organic compounds that are considered to be hazardous air pollutants (HAP) by the USEPA. VOC HAP are measured by EPA Method TO-15.

A summary of the primary parties involved in this test initiative is presented in Table 1-1. A summary of test parameters and methods applicable to this program can be found in Table 1-2.

1.2 Program Overview

The objective of the emission test program was to gather VOC and HAP emissions information from a residual oil storage tank and associated tanker trucks under a variety of test scenarios as prescribed by EPA Region I staff. For the purposes of this report, VOCs are also referred to as “non-methane hydrocarbons or NMHC”. The following summarizes the program objectives.

1) Storage Tank 30-Day VOC Sampling – The VOC concentration and emission rate of Storage Tank No. 3 was continuously monitored and logged over a 30-day period at the outlet of the TTE exhaust system that was fitted over the two exhaust vents on the storage tank roof. VOC measurements commenced seven days prior to the beginning of the transfer of oil from the vessel "New Hampshire" to the storage tank, and then continued during and after the tank filling process to collect a total of thirty days of continuous emissions data. EPA Methods 18 (methane) and 25A (total hydrocarbons) were utilized for VOC sampling. Final results were reported in terms of non-methane hydrocarbons (NMHC) in which methane is subtracted from total hydrocarbons on a lb/hr basis. Concurrent with VOC sampling, volumetric flow rate was measured continuously using a pitot tube/pressure transducer/thermocouple system. The data was logged continuously on a computer. Flow data was used to calculate VOC and HAP mass emissions.

2) Storage Tank VOC Sampling During Vessel Transfer –.VOC concentration and emission rate from the storage tank were quantified as a vessel offloaded approximately 46,544 barrels of No. 6 fuel oil into the tank over a 13-hour period. The VOC concentration was measured in accordance with EPA Methods 18 and 25A at the outlet of the TTE exhaust system. Volumetric flow data was obtained by calculating the cubic feet per hour of air displaced from the tank vents, based on the hourly fuel oil transfer rate from the vessel into the storage tank. Volumetric flow data was used to calculate the hourly VOC mass emission rate from the storage tank vents during this process.

3) Tanker Truck VOC Sampling – The VOC concentration and emission rate from truck loading operations were quantified during ten filling cycles. The headspace VOC concentration of the tanker was measured in accordance with EPA Methods 18 and 25A while the tanker was being filled with No. 6 fuel oil. Sampling occurred just inside the tank fill hatch using a stainless steel probe equipped with a filter, a second heated filter, and heated sample line that delivered the sample to the analyzer. Tank exhaust volumetric flow rate was calculated based on the oil fill rate of the truck in gallons per hour, and the resultant displacement of air in cubic feet per hour. This data was used to calculate VOC mass emissions from truck loading operations.

4) VOC HAPS Sampling – Approximately once per week during the 30-day test period, a Summa sample was collected from the storage tank TTE exhaust system in a prepared Summa canister, and was analyzed for VOC Hazardous Air Pollutants (HAP) in accordance with EPA Method TO-15. A total of four VOC HAP samples was collected during Storage Tank static breathing. Additionally, a single Summa sample was collected from the TTE exhaust system during Storage Tank loading from a vessel. Finally, a single Summa was collected during one of the ten tanker truck loading tests, Each Summa sample was analyzed for the VOC HAP compounds identified in EPA Method TO-15. Additionally, the largest 20 tentatively identified compounds (TIC) were quantified. Results are reported in units of concentration (ppb) and mass emission rate (lb/hr).

1.3 Technical Approach to Sampling

1.3.1 Storage Tank Sampling – Static Breathing

One of the unique challenges of this program was to quantify representative VOC mass emissions from the Storage Tank vents as they naturally vent or out-gas. Whereas measuring VOC concentration in the exhaust vents was fairly straightforward, measuring exhaust volumetric flow rate from the tank vents during idle periods was difficult since the flow rate of each tank vent was extremely low and likely to be undetectable using conventional EPA Method 2 procedures.

The objective was to capture the vapors that naturally out-gas from the Storage Tank vents, while also achieving a measurable flow rate, but without inducing excessive draft across the vent openings. EPA has not promulgated an applicable test method for this measurement. Per EPA Region I staff direction, a Temporary Total Enclosure (TTE) Exhaust System was constructed around each of the two tank vents. The exhaust of each TTE was combined into a common exhaust duct. Each TTE was large enough to encapsulate the entire vent. Each TTE was fitted with one natural draft opening (NDO) that had an adjustable damper to vary its size. The TTE common exhaust duct was fitted with an exhaust fan. The purpose of the fan was: 1) to draw tank VOC emissions from the TTEs into a common exhaust duct where emissions were measured; 2) to achieve a measurable flow rate in the exhaust duct; and 3) to balance the static pressure in the TTE to approximately negative 0.10 inches water column (but never below negative 0.007 inches water column), thus achieving 100% capture of tank gases while minimizing the negative pressure of the TTE. The exhaust fan speed, the exhaust fan adjustable waste gate, and the NDO adjustable gates were varied to achieve this optimal set point during natural out-gassing.

All Storage Tank sampling took place in the common exhaust duct prior to the ID fan. A small S-type pitot tube was securely mounted in the exhaust duct at a traverse point of average velocity, and the VOC sampling probe was securely mounted in the duct center and approximately two duct diameters downstream of the pitot tube. An S-type pitot was selected over a standard pitot to avoid clogging of the pitot openings. However, the pitot tip was fabricated with 3/16" stainless steel to minimize the size of the pitot.

The Method 25A/18 VOC/methane sample was collected from the TTE exhaust duct upstream from the exhaust fan. The sampling probe was swage-locked directly onto the sampling port to ensure a leak-free fitting. A quartz fiber filter, heated to 275°F, was placed in-line between the probe and sample line. The sample was transported to the VOC analyzer via approximately 100 feet of heated Teflon sample line (set at 275°F). The pitot and thermocouple were connected to a 250-foot flow line that was in turn connected to a pressure transducer/digital temperature readout. The signals from the VOC and methane analyzers and the pressure transducer/temperature readout were recorded on a data acquisition system (DAS) consisting of a data logging device and a computer. The DAS was programmed to collect data every 2 seconds, and record the data once every minute as an average of the thirty 2-second data points.

Throughout the testing period, any anomalies in the testing or process operations were immediately reported to the Eastmount Project Director, who then contacted the EPA.

Testing was conducted in strict accordance with the approved Pretest Protocol, the EPA Quality Assurance Handbook for Air Pollutant Measurement Systems – Vol. III, and the applicable EPA Methods as found in 40 CFR 60, Appendix A, as amended.

1.3.2 Storage Tank Sampling – Vessel Transfer

During storage tank loading from the vessel, the flow and pressure dynamics of the TTE Exhaust System changed because air was displaced from the tank as it filled with oil. In this case, the TTE exhaust system flow rate was increased to compensate for the vessel air displacement rate, and the NDOs were completely shut to capture all displaced gas from the tank, and direct it to the common exhaust duct. The calculated exhaust flow rate of tank air displaced by the transfer of fuel from the vessel into the tank was used in the calculation of actual VOC emissions from the storage tank during the 13-hour vessel transfer period. The TTE exhaust system sampling location was still used to measure the VOC concentration.

1.3.3 Tanker Truck Sampling

VOC concentration was measured directly from the tanker truck filling hatch on the top of the tanker. A fuel oil filter, wrapped with fiberglass cloth, was securely attached to the end of an unheated length of 3/8" stainless steel to be used as a probe. A heated filter was placed in-line between the probe and heated Teflon sample line, which then delivered the gas sample to the VOC analyzer. Care was taken to ensure that the probe tip did not come in contact with the fuel oil in the tank. The fiberglass cloth was periodically replaced on the probe tip filter as it became coated with oil. The volumetric flow rate of air being displaced by the fuel oil entering the tank was calculated based on the fill rate of each truck. This data was used to calculate the mass emissions of VOC.

1.4 Report Organization

The remainder of this Final Report is divided into four additional sections. The Summary of Results for the entire program in presented in Section 2. A description of the facility and sampling locations is presented in Section 3. Emissions monitoring equipment and procedures are described in Section 4. Section 5 addresses the quality assurance/quality control aspects of the program. All supporting field data, calculations, calibrations, test logs, and process data are appended to the Final Report.

Table 1-1 Test Program Informational Summary

Facility Corporate Information	
Corporate Organization:	Sprague Operating Resources LLC
Address:	Two International Drive. Suite 200 Portsmouth, NH 03801
Contact:	Ms. Elizabeth Hernberg Managing Director
Phone:	(603) 430-7298
Email:	EHernberg@spragueenergy.com
Facility Information	
Facility Name:	Sprague Operating Resources LLC
Address:	70 Trundy Road Searsport, ME 04974
Contact:	Mr. Paul Barragan Terminal Manager
Phone:	(207) 548-2531
Test Firm Information	
Test Organization:	Eastmount Environmental Services, LLC
Address:	2 New Pasture Road, Unit 5 Newburyport, MA 01950
Contact:	Mr. Anthony M. Stratton Vice President – Technical Services
Office Phone: Mobile Phone	(978) 499-9300 x12 (508) 989-8996
Email:	astratton@eastmount.com
Regulatory Information	
Organization:	US EPA New England Regional Lab
Address:	11 Technology Drive North Chelmsford, MA 01863-2431
Contact:	William Osbahr
Phone:	(617) 918-8389
Email:	osbahr.william@epamail.epa.gov

Table 1-2 Summary of Parameters and Test Methods

Test Location	Parameter	Test Method	Number of Runs
Storage Tank Exhaust Vent	Total VOC (as propane)	EPA 25A	Continuous sampling over 30 days
	Methane	EPA 18	
	Volumetric Flow [1]	EPA 2C	Continuous sampling over 30 days
	VOC HAPS (TO-15 list plus the first 20 TICs [2])	EPA TO-15	1 Summa canister/week plus one Summa during tank filling (5 samples total)
	Capture (static pressure of TTE)	EPA Method 204	Verified daily
Tanker Truck Fill Hatch	Total VOC (as propane)	EPA 25A	Continuous sampling of 10 tanker truck filling cycles
	Methane	EPA 18	
	VOC HAPS (TO-15 list plus the first 20 TICs [1])	EPA TO-15	1 Summa canister during tanker truck filling
	Volumetric Flow	Calculated based on tank volume displacement	10 filling cycles

[1] Volumetric flow rate during Vessel Transfer was calculated based on tank volume displacement.

[2] Tentatively identified compounds

2.0 SUMMARY OF RESULTS

2.1 Overview

The following presents the results for VOC and HAP Residual Oil Storage Tank Test Program, and also a discussion of observations made during the test procedures.

Table 2-1 below provides an overall summary of the test results for this program. Table 2-2 summarizes the annual VOC (or non-methane hydrocarbon) emissions from No. 6 fuel oil sources at the Searsport, Maine Terminal over the last five years using the factors developed during the testing. Table 2-3 summarizes the annual VOC HAP emission from No. 6 fuel oil sources at the Searsport, Maine terminal over the last five years. This information is based on historical terminal activity and the VOC and VOC HAP emissions data collected during the June-July 2012 thirty day monitoring period, including static tank breathing, vessel transfer and truck loading activities.

Table 2-4 in Section 2.2 summarizes the VOC emissions results of direct measurement of a single tank vent (no TTE). Tables 2-5 through 2-9 in Section 2.3 summarize the overall VOC emissions data collected over the 30-day period. Informational graphs are presented in Figures 2-1 and 2-2 in Section 2.2, and Figures 2-3 and 2-4 in Section 2.3.

Table 2-1 Overall Summary of Test Results – Residual Oil Storage Tank #3

Source	VOC	HAP
Tank Breathing (tons/year)	10.6	1.7
Vessel Transfer (lbs/hr)	11.2	1.4
Truck Transfer (lbs/transfer)	0.4	0.1

Table 2-2 Facility VOC Emissions from No. 6 Fuel Oil Sources

Tank Breathing	10.6	tons/year
Vessel Transfer	11.2	lbs/hour
Truck Transfer	0.432	lbs/transfer

	2007	2008	2009	2010	2011
Subtotal Truck Volume (gal)	90,782,328	66,963,627	43,544,369	30,383,692	34,208,974
Number of Truck Loads (9K gal/load)	10,087	7,440	4,838	3,376	3,801
Truck Rack VOC Emissions (tons/year)	2.2	1.6	1.0	0.7	0.8
Subtotal Vessel Volume (Bbls)	2,021,449	1,549,601	1,050,992	631,291	749,874
Transfer Time @3553 Bbls/hr (hrs)	569	436	296	178	211
Vessel Transfer VOC Emissions (tons/year)	3.2	2.4	1.7	1.0	1.2
Number of #6 Oil Tanks	2	2	2	2	2
Tank Breathing VOC Emissions (tons/year)	21.2	21.2	21.2	21.2	21.2
Total Calculated #6 Oil VOC Emissions (tons/year)	**26.6**	**25.2**	**23.9**	**22.9**	**23.2**

Table 2-3 Facility VOC HAP Emissions from No. 6 Fuel Oil Sources

Tank Breathing	1.7	tons/year
Vessel Transfer	1.40	lbs/hour
Truck Transfer	0.07	lbs/transfer

	2007	2008	2009	2010	2011
Subtotal Truck Volume (gal)	90,782,328	66,963,627	43,544,369	30,383,692	34,208,974
# of Truck Loads (9K gal/load)	10,087	7,440	4,838	3,376	3,801
Truck Rack VOC HAP Emissions (tons/year)	0.4	0.3	0.2	0.1	0.1
Subtotal Vessel Volume (Bbls)	2,021,449	1,549,601	1,050,992	631,291	749,874
Transfer Time @3553 Bbls/hr (hrs)	569	436	296	178	211
Vessel Transfer VOC HAP Emissions (tons/year)	0.4	0.3	0.2	0.1	0.1
Number of #6 Oil Tanks	2	2	2	2	2
Tank Breathing VOC HAP Emissions (tons/year)	3.475	3.475	3.475	3.475	3.475
Total Calculated #6 Oil VOC HAP Emissions (tons/year)	**4.2**	**4.0**	**3.9**	**3.7**	**3.8**

2.2 Discussion of Program Observations

This project was completed in accordance with the program objectives and the approved Test Protocol. Eastmount was able to adhere to EPA reference methodology throughout the program with regard to volumetric flow measurement, analyzer daily calibrations, VOC sample acquisition, and capture of VOC emissions. Daily post-test calibrations were conducted on the total hydrocarbon and methane analyzers which successfully demonstrated daily linearity throughout entire program. There was no evidence of significant velocity pressure transducer zero drift, and the pitot tubes never became heavily coated or clogged with oil mist. The static pressure of the two TTEs was maintained below -0.007 inches water column throughout the 30-day period, except for three days when a minor adjustment to the TTE system was needed (typically accomplished by either by re-zeroing the pressure gauge(s) or adjusting the NDO settings).

Some observations made during the program deserve mention as they may be relevant to the representativeness of the test results. These observations are discussed below. Despite strict adherence to the EPA protocol, Section 2.2.2 addresses inherent issues with applying this methodology to this test program.

2.2.1 Effect of Oil Mist on the Sampling System

As evidenced by the coating of oil mist on the TTE System exhaust and the surrounding roof area, the TTE fan was effectively drawing tank fumes from two tank vents. For the first seven days of the 30-day period, Eastmount did not use a heated filter at the base of the VOC probe, which may have allowed oil mist to coat the inside walls of the heated Teflon sample line. This was indicated by very slow VOC monitoring system response to zero gas, and a consistent positive bias of approximately 200 ppm (as propane) during zero calibrations. Once a heated filter was placed in-line at the probe base (on the day prior to vessel transfer) and the line was cleaned, system response to zero gas was much faster and generally achieved values below 50 ppm (as propane).

Eastmount unsuccessfully tried to quantify a possible positive bias by installing a freshly cleaned heated sample line in the system, conducting a full system calibration, sampling the tank VOC, and observing the VOC ppm concentration which initially climbed rapidly to 1000 ppm in the first 2 minutes, and then slowly climbed before leveling off at approximately 1800 ppm over a period of approximately 15 minutes. Although it was not possible to quantify a bias, it appeared as if oil mist was coating the lines, and off-gassing VOC into the sampling system.

It is observed that the VOC mass emissions measured over two days after the vessel transfer, when the new filter was in-line, were very similar to those data collected prior to the vessel transfer when no filter was in-line, and therefore one may conclude that installing the filter did not have a significant effect on the VOC data. However, there was a significant improvement in the system response to zero gas in terms of reduced time and reduced concentration (typically below 50 ppm).

2.2.2 TTE Static Pressure and the Effect of Volumetric Flow on VOC Emissions

The representativeness of the 24-hour VOC emissions data collected from the storage tank over the 30-day period largely depends on the flow dynamics that were occurring inside the EPA Method 204 TTE Exhaust System that was temporarily erected around the tank's two exhaust vents. The Protocol for sampling with this particular configuration was untested and unprecedented in this application, and therefore required much field experimentation, especially during the first ten days of the program. Whereas EPA Method 204 is well suited to capturing gases and fumes from indoor VOC coating applications, using this system to capture fumes from a passive ventilation source in an outdoor setting with typically windy conditions posed many challenges. In this case, the goal was to demonstrate 100% capture of tank off-gas without oversampling the passive ventilation system and thus creating additional emissions.

Wind from Penobscot Bay posed the greatest challenge in maintaining slight TTE negative pressure. As there was almost always a breeze blowing directly on one of the two TTE natural draft openings (one faced south and the other face north), the flow rate of the TTE system had to be maintained at a fairly high level in order to maintain the TTE static pressure at approximately -0.01 inches water column. Eastmount initially ran the TTE System at a flow rate of approximately 280 scfm for the first ten days of sampling, after which period the flow rate was reduced to approximately 250 scfm while maintaining good TTE negative pressure.

Figure 2-1 on the following page depicts a trend between mass emissions and the TTE system velocity pressure over the 30-day sampling period. The trend indicates a noticeable decrease in VOC mass emissions after the flow rate was reduced on June 22 and then again on June 25. It is observed that the VOC emissions dropped by 31% on June 26, and remained at a reduced level for the duration of the program.

A second observation that indicates a direct correlation between TTE system velocity pressure and VOC mass emissions is depicted in Figure 2-2. It demonstrates that prior to vessel sampling on June 20, the velocity pressure was set at -0.10 inches of water, and the VOC mass emission rate was approximately 3 lbs/hr. Just prior to the vessel transfer period, the TTE fan speed was increased to achieve a velocity pressure of approximately -0.30 inches of water as needed to capture tank emissions caused by displacement of air as the fuel filled the tank. The flow rate was allowed to remain at that increased setpoint until midday on June 21, 16 hours after completing the vessel transfer. During this 16-hour period, the VOC mass emissions rate was elevated to approximately 8 lbs/hr. However, once the fan speed was reduced back to a normal velocity pressure of -0.10 inches, the VOC mass emission rate instantly decreased to 3 lbs/hr. It can be concluded that oversampling with the TTE system flow rate can cause a significant positive bias of VOC mass emissions.

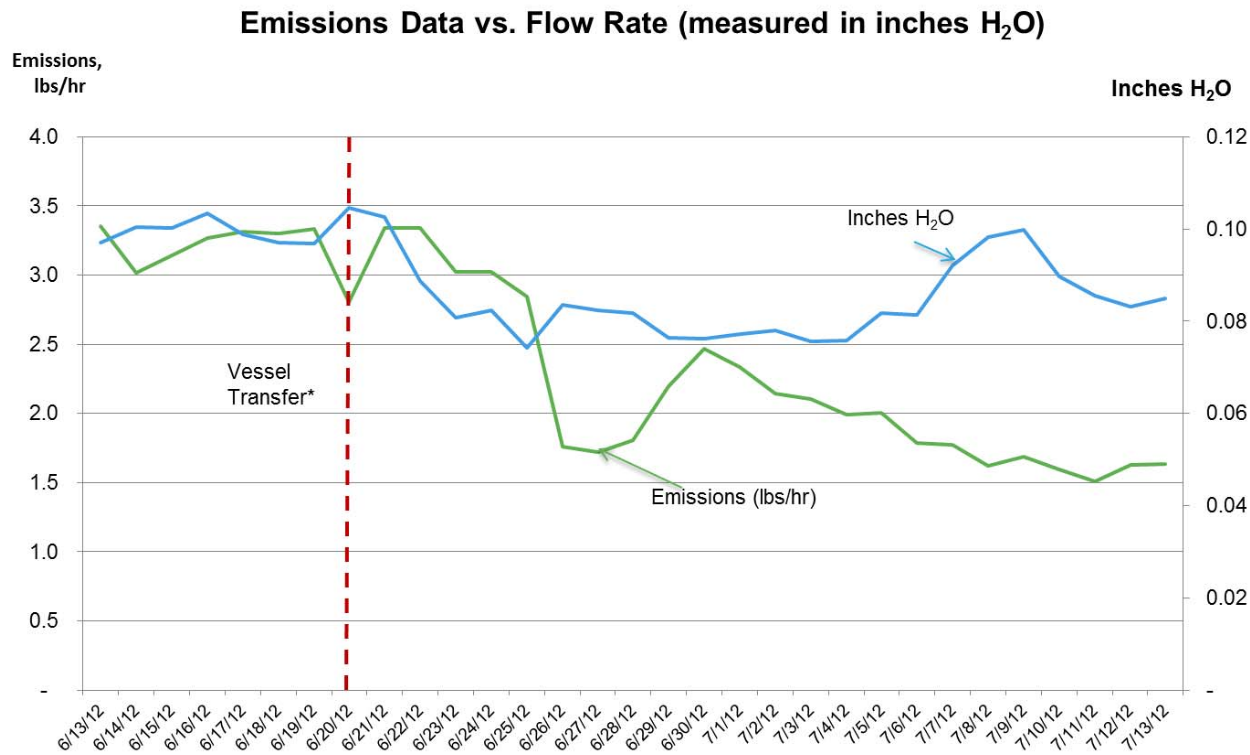

Figure 2-1 30-Day Trend of VOC Mass Emissions vs. TTE System Velocity Pressure

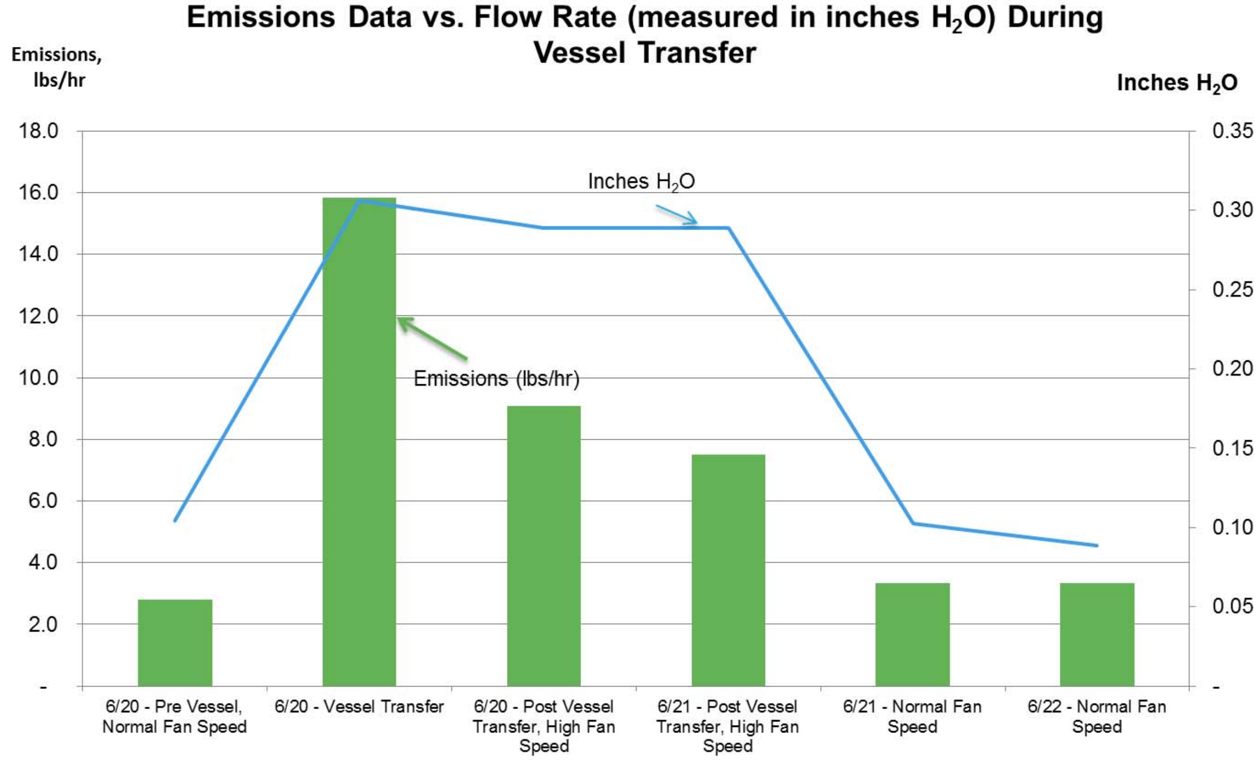

Figure 2-2 Correlation of Fan Speed to VOC Mass Emission Rate

2.2.3 Direct Sampling of a Single Tank Vent

Following the 30-day sampling period required by EPA, Eastmount made a direct measurement of velocity pressure and VOC concentration on one tank vent without the TTE installed, and with the second tank vent completely sealed. Eastmount used a pressure transducer with a 0.001" sensitivity, a pitot tube to measure velocity, and a Tedlar bag to collect a VOC sample. It was a very windy day, with a steady 20 mph South wind blowing across the tank roof. The vent did not meet the criteria of EPA Method 1 with regard to upstream/downstream disturbances. The vent inside diameter was 12 inches. A single, threaded port was installed in the side of the vent where the pitot tube was locked into place in the center of the vent. A definitive velocity pressure could not be detected as the pressure transducer varied from 0.001" to zero to -0.001". The onsite Tedlar bag analysis resulted in THC of approximately 1800 ppm, and methane of approximately 150 ppm. Table 2-3 below summarizes the VOC emissions results of the direct vent measurement. Volumetric flow rate is based on the 0.001" water column detection limit of the pressure transducer.

Table 2-4 VOC Emissions from Direct Measurement of a Single Tank Vent

Parameter	Result
Delta P (" water column)	< 0.001
Volumetric Flow (scfm)	84
VOC (ppm as propane)	~1800
Methane (ppm)	~150
Non-Methane Hydrocarbons (lb/hr)	~1.0
Non-Methane Hydrocarbons (tons/year)	~4.4

2.3 Summary of Results - VOC/HAP Residual Oil Storage Tank Test Program

This section contains summary tables of VOC data collected over the 30-day period.

Table 2-4 summarizes the daily non-methane hydrocarbon (NMHC) emissions results on Tank No. 3 over a 30-day period (6/13/12 through 7/13/12) during normal tank breathing. All supporting data and calculations are contained in Appendix A.

Table 2-5 summarizes NMHC emissions measured during a transfer of approximately 46,544 barrels (1,954,848 gallons) of No. 6 fuel oil from the vessel “New Hampshire” into Tank No. 3 over a 13-hour period on 6/20/12. All supporting data and calculations are contained in Appendix B.

Table 2-6 summarizes the NMHC emissions measured at the truck loading rack on 7/31/12 during ten filling cycles. All supporting data and calculations are contained in Appendix C.

Table 2-7 summarizes the VOC HAP emissions results (Summa sampling) during normal tank breathing. All supporting data and calculations are contained in Appendix D.

Table 2-8 summarizes the VOC HAP emissions results during vessel transfer and tanker truck loading operations. All supporting data and calculations are contained in Appendix D.

Figure 2-3 contains a graph that compares VOC mass emissions to percent of tank capacity.

Figure 2-4 shows the intra-day trend of average VOC lb/hr and THC ppm over a 24-hour period.

Table 2-5 No. 6 Oil Non-Methane Hydrocarbon Emissions Summary – Static Tank Breathing

Date	TTE #1 Pressure (In. w.c.)	TTE #2 Pressure (In. w.c.)	Daily Cal Status	Tank Temp (°F)	Tank Capacity (%)	Volumetric Flow Rate (scfm)	Non-Methane Hydrocarbons (Lb/hr)	Non-Methane Hydrocarbons (Tons/year)
06/13/12	-0.050	-0.040	Good	130.4	20.38	281	3.36	14.7
06/14/12	-0.050	-0.060	Good	129.8	18.73	286	3.04	13.3
06/15/12	-0.008	-0.020	Good	128.7	17.93	285	3.17	13.9
06/16/12	-0.015	-0.035	Good	128.5	17.81	289	3.27	14.3
06/17/12	-0.028	-0.022	Good	126.5	17.53	283	3.31	14.5
06/18/12	-0.025	-0.015	Good	126.7	16.78	280	3.30	14.5
06/19/12	-0.030	-0.020	Good	122.3	16.29	280	3.34	14.6
06/20/12	+0.024	+0.013	Good	125.9	72.50	Vessel Transfer - See Table 2-2		
06/21/12	-0.020	-0.015	Good	125.4	71.84	283	3.36	14.7
06/22/12	-0.017	-0.023	Good	122.6	71.10	265	3.34	14.6
06/23/12	-0.009	-0.024	Good	124.7	70.86	255	3.02	13.2
06/24/12	no data	-0.055	Good	123.9	70.40	256	3.03	13.3
06/25/12	+0.015	-0.022	Good	123.7	69.83	244	2.84	12.5
06/26/12	-0.015	-0.020	Good	123.8	69.45	238	1.95	8.6
06/27/12	-0.045	-0.008	Good	123.8	68.66	259	1.71	7.5
06/28/12	-0.007	+0.01	Good	122.9	67.77	256	1.80	7.9
06/29/12	-0.010	-0.010	Good	123.9	67.15	248	2.19	9.6
06/30/12	no data	no data	no data	123.6	67.02	245	2.47	10.8
07/01/12	-0.007	-0.020	Good	123.2	66.89	247	2.33	10.2
07/02/12	-0.007	-0.020	Good	123.4	65.60	249	2.14	9.4
07/03/12	-0.009	-0.020	Good	123.7	65.09	245	2.11	9.2
07/04/12	-0.038	-0.012	Good	124.3	64.80	247	1.99	8.7
07/05/12	-0.007	-0.060	Good	123.3	64.42	255	2.01	8.8
07/06/12	-0.008	-0.007	Good	122.8	63.95	254	1.78	7.8
07/07/12	+0.040	-0.012	Good	121.8	93.57	269	1.77	7.8
07/08/12	-0.013	-0.012	Good	121.4	63.31	279	1.62	7.1
07/09/12	+0.010	-0.030	Good	121.2	62.85	282	1.69	7.4
07/10/12	-0.010	-0.010	Good	121.4	62.33	267	1.60	7.0
07/11/12	-0.007	-0.011	Good	121.2	61.65	261	1.50	6.6
07/12/12	-0.010	-0.010	Good	121.1	61.12	257	1.63	7.1
07/13/12	-0.010	-0.010	Good	121.3	60.49	260	1.64	7.2
AVERAGE:						**264**	**2.41**	**10.6**

Table 2-6 No. 6 Oil Non-Methane Hydrocarbon Emissions Summary – Vessel Transfer 6/20/12

Hour No.	Start Time	End Time	Oil Transfer (barrels)	Transfer Rate (barrels/hr)	Displ. Flow Rate (scfm)	Measured Flow Rate (scfm)	THC as C3H8 (lb/hr)	CH4 (lb/hr)	NMHC (lb/hr)	NMHC (tons/hr)
1	7:45	8:44	8291	4167	386	507	11.90	0.62	11.28	5.64E-03
2	8:45	9:44	8293	3776	350	500	12.17	0.64	11.53	5.76E-03
3	9:45	10:44	8298	3776	350	501	12.37	0.65	11.72	5.86E-03
4	10:45	10:44	8293	3511	325	497	11.55	0.61	10.94	5.47E-03
5	11:45	12:44	8291	3511	325	498	11.66	0.62	11.05	5.52E-03
6	12:45	13:44	8293	3416	317	496	11.42	0.61	10.81	5.40E-03
7	13:45	14:44	8298	3416	317	494	11.51	0.61	10.89	5.45E-03
8	14:45	15:44	8293	3788	351	496	12.76	0.69	12.07	6.04E-03
9	15:45	16:44	8291	3788	351	493	13.03	0.69	12.34	6.17E-03
10	16:45	17:44	8293	3114	289	497	11.13	0.57	10.56	5.28E-03
11	17:45	18:44	8298	3114	289	493	10.39	0.55	9.84	4.92E-03
12	18:45	19:44	8293	3403	315	491	12.57	0.65	11.92	5.96E-03
13	19:45	20:44	8294	3403	315	485	10.91	0.60	10.31	5.15E-03
Average:			**8294**	**3553**	**329**	**496**	**11.80**	**0.62**	**11.17**	**5.59E-03**
Total Tons NMHC Per Vessel Transfer =				**7.26E-02**						

Note 1: One barrel = 5.56 cubic feet

Note 2: NHMC emisisons calculating using measured volumetric flow rate.

Note 3: One transfer takes approximately 13 hours.

Table 2-7 No. 6 Oil Non-Methane Hydrocarbon Emissions Summary – Truck Loading 7/31/12

Truck No.	Start Time	End Time	Load Time (minutes)	Load (gallons)	Fill Rate (gal/hr)	Displacement (scfm)	NMHC (lb/hr)	NMHC (lb/load)	NMHC (Ton/load)
1	7:21	7:46	26	8285	19119	42.6	1.17	0.509	2.54E-04
2	8:47	9:11	25	8291	19898	44.3	1.12	0.468	2.34E-04
3	10:02	10:32	31	8291	16047	35.8	0.83	0.430	2.15E-04
4	11:23	11:46	24	8283	20708	46.1	1.25	0.500	2.50E-04
5	12:02	12:26	25	8291	19898	44.3	0.97	0.406	2.03E-04
6	12:34	12:59	26	8293	19138	42.6	0.99	0.428	2.14E-04
7	13:08	13:33	26	8298	19149	42.7	0.89	0.387	1.93E-04
8	13:43	14:07	25	8293	19903	44.3	0.98	0.407	2.04E-04
9	14:23	14:46	24	8292	20730	46.2	0.99	0.396	1.98E-04
10	14:55	15:19	25	8294	19906	44.3	0.94	0.390	1.95E-04
Average:			**26**	**8291**	**19450**	**43.3**	**1.01**	**0.432**	**2.16E-04**

Note: One Gallon = 0.13368 cubic feet

Table 2-8 No. 6 Oil VOC HAP Emissions – Tank Breathing

Summa No.	Activity	Date	Time	Max HAP Compound	Max HAP (Tons/year)	Sum of Detected HAP (Tons/year)	Sum of Detected + Nondetected HAP (Tons/year)	Sum of TICs (Tons/year)
1	Breathing	6/13/12	15:45-16:45	Xylene (Total)	3.88E-01	1.43E+00	1.63E+00	2.45E+00
3	Breathing	6/24/12	14:30-15:30	Hexane	1.67E-01	8.61E-01	1.31E+00	1.16E+00
4	Breathing	7/3/12	15:15-16:15	Hexane	3.06E-01	1.67E+00	2.41E+00	3.11E+00
5	Breathing	7/13/12	15:25-16:25	Hexane	2.03E-01	1.07E+00	1.61E+00	2.12E+00

Table 2-9 No. 6 Oil VOC HAP Emissions – Vessel/Truck Transfer

Summa No.	Activity	Date	Time	Max HAP Compound	Max HAP (Tons/transfer)	Sum of Detected HAP (Tons/transfer)	Sum of Detected + Nondetected HAP (Tons/transfer)	Sum of TICs (Tons/transfer)
2	Vessel Transfer	6/20/12	12:00-16:10	Xylene (Total)	1.81E-03	7.26E-03	9.13E-03	6.70E-03
6	Truck Loading	7/31/12	08:45-09:00	Xylene (Total)	5.30E-06	3.01E-05	3.53E-05	5.09E-05

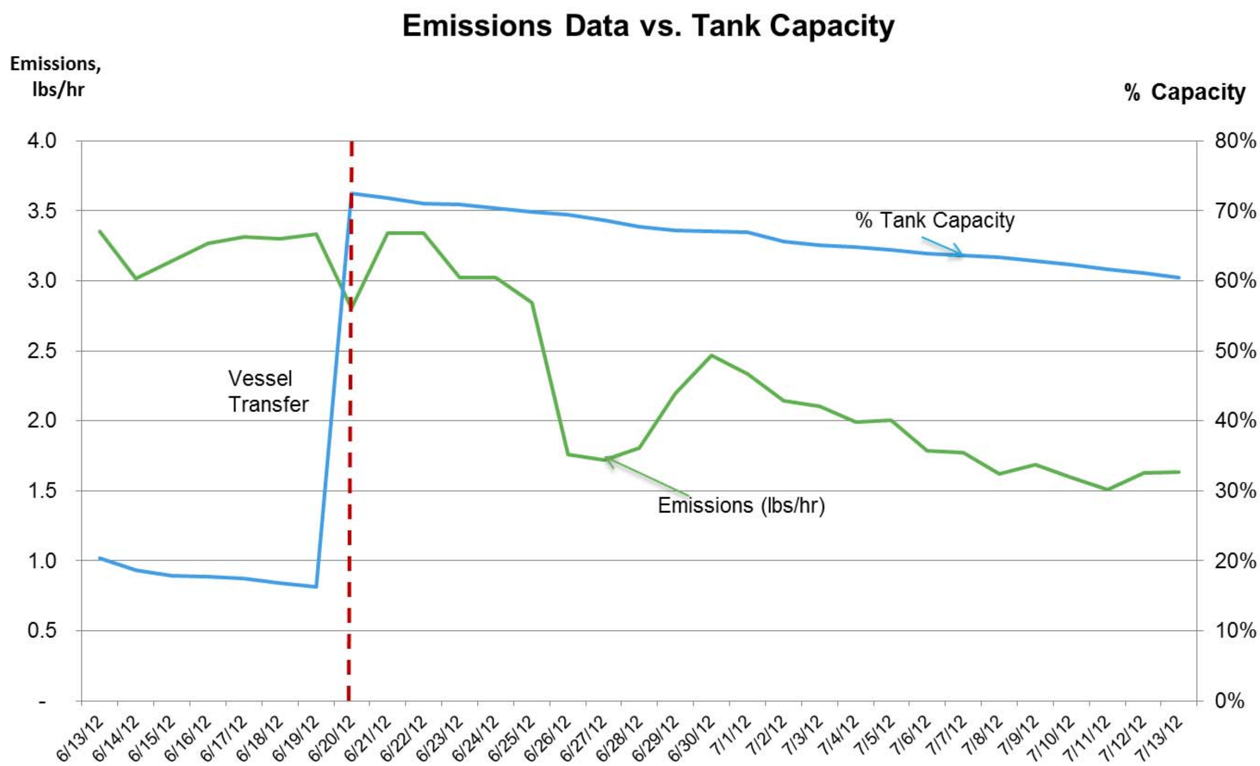

Figure 2-3 NMHC Emission Rate vs. % Tank Capacity

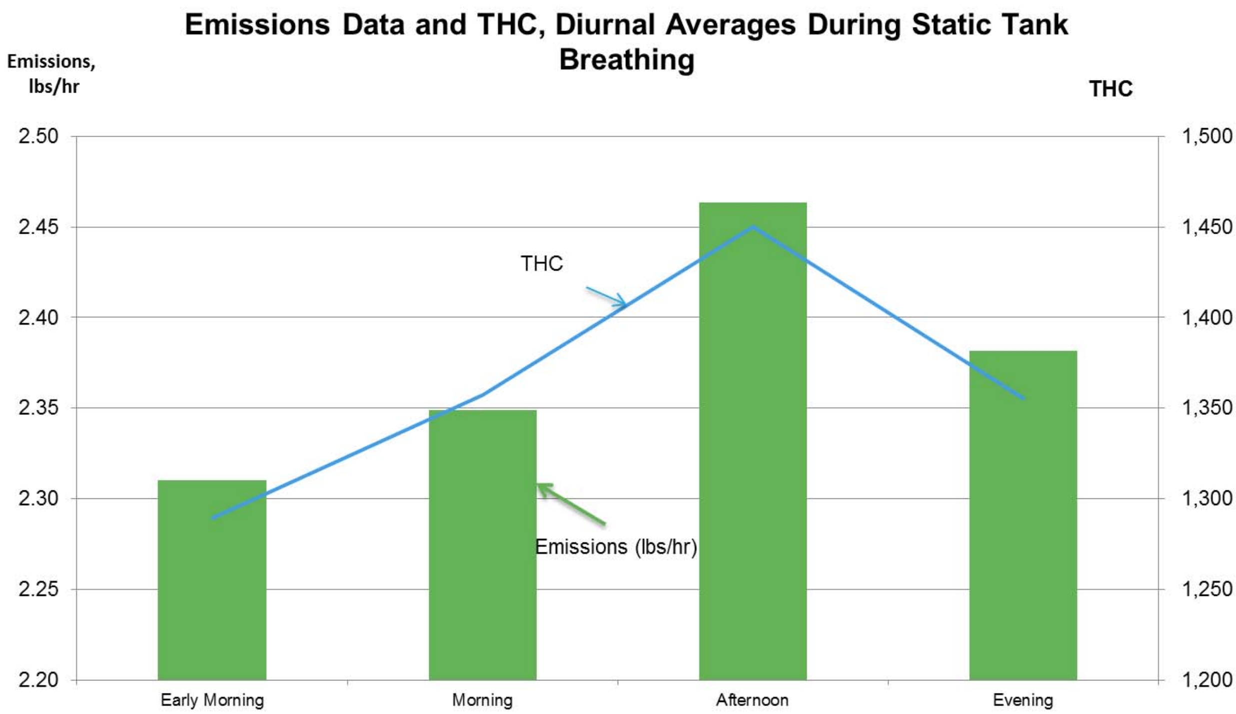

Figure 2-4 Intra-day Averages of VOC Emissions During Static Tank Breathing

3.0 PROCESS DESCRIPTION AND SAMPLING POINT CONFIGURATION

3.1 Facility Description

Sprague began operations at the Searsport facility in the early 1900's when it was used for the storage of bulk steam coal. The terminal is now a multi-use facility that handles bulk liquid cargoes, dry bulk products, and special heavy lift projects. Petroleum product storage includes No. 2 fuel oil, No. 6 fuel oil, ultra low sulfur diesel, and asphalt. In addition, Sprague transfers Irving products (gasoline, No. 2 oil, diesel, kerosene and asphalt) from Irving vessels through pipe lines to their terminal, located to the east of Sprague's property.

The Searsport Terminal has a total of nineteen (19) aboveground oil storage tanks. The total oil storage capacity of the terminal is 1,150,449 barrels, or 48,318,844 gallons. Approximately 5000 barrels of product are transferred through the facility on a daily basis. An estimated 30-40 tank trucks are loaded on a daily basis.

Products are primarily delivered to the Searsport Terminal by barges, tankers and ships. The terminal is staffed 24 hours per day, 365 days per week.

3.2 Sampling Location Description

3.2.1 Residual Oil Storage Tank

Emissions from Residual Oil Storage Tank No. 3 were quantified from the two exhaust vents on the tank roof. A Temporary Total Enclosure (TTE) was constructed around each vent such that each TTE completely encapsulated each vent. Each TTE was equipped with a single natural draft opening (NDO) with a variable damper, and an exhaust duct of 7 inches inside diameter. The two exhaust ducts converged into a common exhaust duct with a 7-inch inside diameter. The common exhaust duct had a straight length of twelve duct diameters before connecting to an induced draft fan with and operating range of approximately 350 to 800 acfm. A waste gate was located just prior to the ID fan and two duct diameters downstream from the sampling ports. The duct flow rate was primarily controlled by adjusting the waste gate opening. The fan speed could further be adjusted by changing the diameter of the belt pulleys. During normal tank breathing, the flow rate of the TTE system was adjusted to the lowest possible setting while maintaining a TTE static pressure of at least negative 0.007" w.c., thus achieving 100% capture in accordance with EPA Method 204. Each TTE was equipped with a static pressure measuring device that was used to verify the TTE static pressure on a daily basis.

All emissions measurements were made in the common exhaust duct prior to the ID fan. The duct was equipped with two national pipe thread (NPT) sampling ports located 90° apart for volumetric flow measurements, and two additional NPT ports located 90° apart for collecting VOC samples.

Figure 2-1 on the following page presents images of the two exhaust vents on the subject residual oil tank that prior to be covered by the TTE Exhaust System. Figure 2-2 presents a general diagram of the Tank vents and the TTE Exhaust System. Figure 2-3 provides an image of the TTE Exhaust System in place on Tank No. 3. Table 2-1 lists the exhaust duct dimensions and corresponding flow traverse points. All dimensions were verified prior to sampling.

3.2.2 Tanker Truck Exhaust Vent

During tanker truck filling at the loading rack, VOC emissions were measured at the tanker truck fill hatch. A continuous gas sample was collected just inside the fill hatch during filling operations. Flow rate was not directly measured, rather it was calculated based on the fill rate of the tank and the resultant displacement of air.

Figure 3-1 Storage Tank No. 3 Exhaust Vents

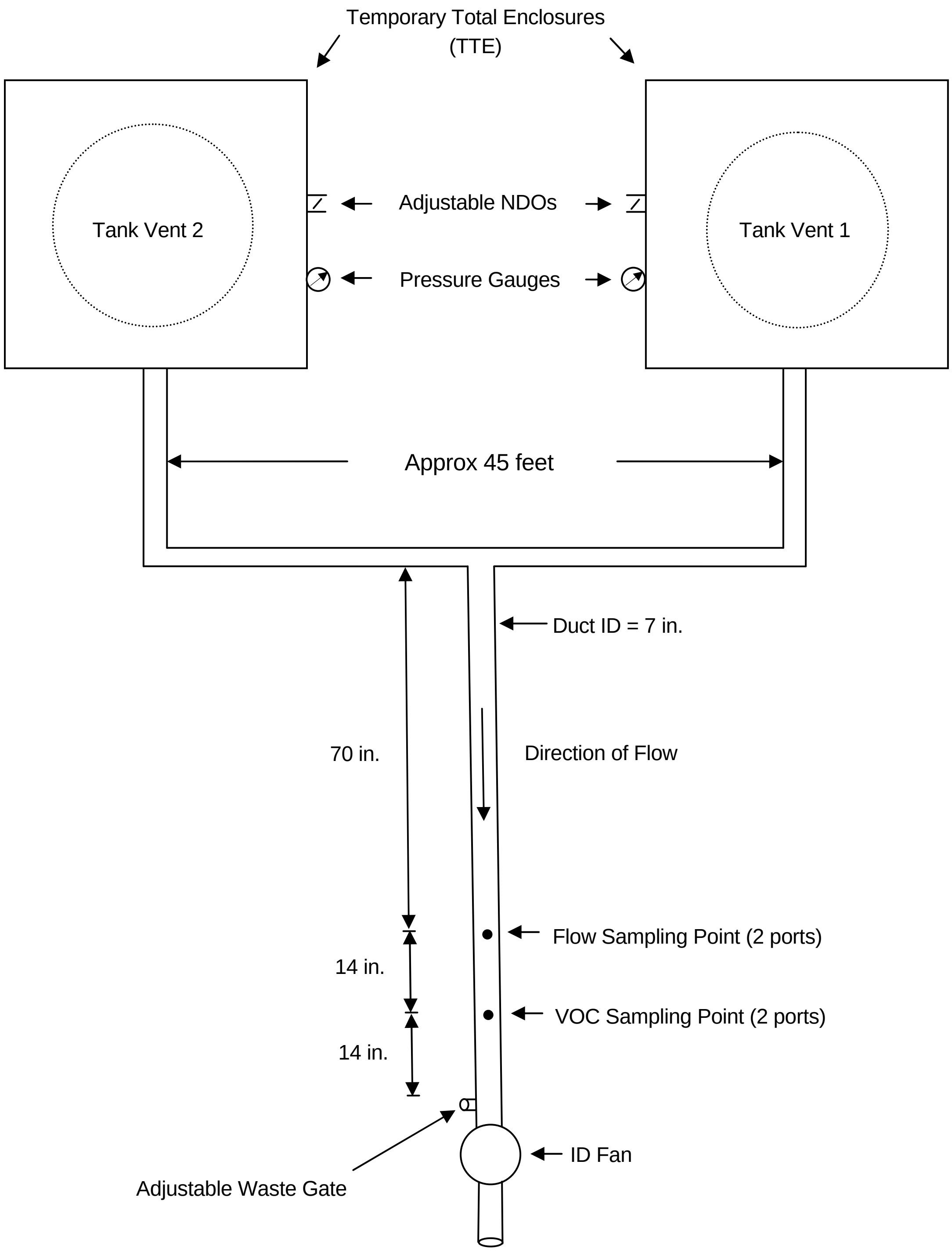

Figure 3-2 Storage Tank No. 3 TTE Exhaust System Diagram

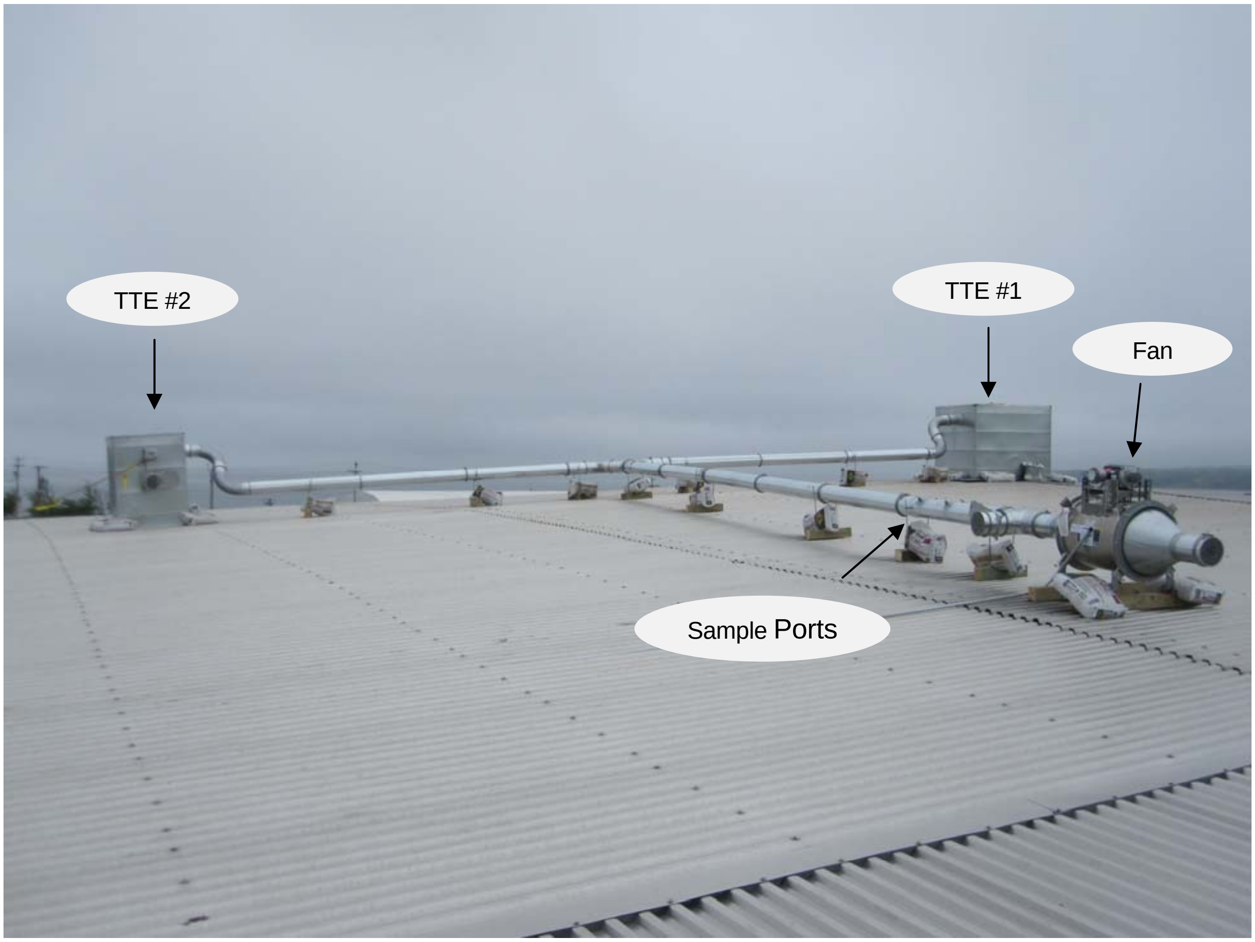

Figure 3-3 Storage Tank No. 3 TTE Exhaust System

Table 3-1 Sampling Configuration – TTE Common Exhaust Duct

– Exhaust Duct Flow Sampling Location –		
Description	**Distance**	**Equivalent Diameters**
From nearest upstream disturbance to sampling ports	70 inches	10.0
From nearest downstream disturbance to sampling ports	14 inches	2.0
Diameter	7 inches	NA
Number of Ports	2	NA
Flow Traverse Points on a Diameter		
Traverse Point No.	**% of Diameter**	**Distance from Inside Wall**
1	6.7	0.5 inches
2	25.0	1.8 inches
3	75.0	5.3 inches
4	93.3	6.5 inches

Notes:

- **VOC and HAP were sampled at a single point in the duct center, 2 diameters downstream from the pitot tube.**
- **Velocity and temperature were measured at a single point in the duct that most closely matched the average velocity obtained during the velocity traverse.**
- **All dimensions were verified prior to sampling.**

4.0 TEST PROCEDURES

4.1 Overview

Emissions testing was conducted to determine the VOC and HAP concentration and mass emission rate of the subject process. Each parameter was measured in strict accordance with official EPA procedures at the sampling locations previously described. This section details the test procedures that were used during this test program.

4.2 Methodology

4.2.1 Non-Methane Hydrocarbons (NMHC) – EPA Methods 25A and 18

Non-methane hydrocarbons (NMHC) were measured at the storage tank exhaust vent and the tanker truck open hatch. NMHC consists of measurements of total hydrocarbons (THC) determined in accordance with EPA Method 25A, and methane (CH_4) determined in accordance with EPA Method 18. Eastmount met the requirements of Methods 25A and 18 by utilizing one VIG Model 200 total hydrocarbon/methane analyzer equipped with a flame ionization detector (FID) for total hydrocarbons, and a methane-specific gas chromatograph (GC) also utilizing an FID.

The THC portion of the analyzer was initially calibrated with zero air and three certified standards of propane-in-balance-air at the beginning of the sampling program, and re-calibrated as necessary throughout the 30-day program. On a daily basis, zero air and an upscale propane standard were introduced to the analyzer through the entire system to determine system drift and accordingly, the validity of the data collected following the previous daily calibration check. All calibrations were performed in accordance with Method 25A and met or exceeded Method 25A accuracy criteria. All data was logged on a computer.

The methane gas chromatograph portion of the analyzer was calibrated in accordance with EPA reference Method 18. Eastmount utilized an internal gas chromatograph (GC) column in the VIG Model 200 to determine methane concentrations. The system was initially calibrated using zero air and three certified standards of methane-in-balance-air introduced to the GC. The GC was fully calibrated at the beginning of the sampling program, thereafter as required. On a daily basis, zero air and an upscale methane standard were introduced to the analyzer through the entire system to demonstrate system drift and to validate sample integrity. Please note that although methane sampling is considered to be continuous, a methane sample injection occurs on a three-minute cycle. All data was logged on a data acquisition system (DAS) consisting of an Iotech DAQ 56 data logger and a computer. Concentration data was recorded by the DAS in two-second intervals, and reported in one-minute averages.

4.2.2 Volumetric Flow Rate (EPA Methods 1-4)

Volumetric flow rate was measured from the storage tank TTE exhaust vent in accordance with EPA Method 2C. Eastmount used an S-type pitot tube manufactured by Apex Instruments. It was constructed of 3/16" tubing to minimize its size within the duct. A K-type thermocouple was incorporated into the pitot assembly which was encased in a ½" stainless steel sheath. This sheath was necessary to allow permanent installation of the pitot tube at the point of average velocity without allowing ambient air from entering the exhaust duct. The pitot tube was connected to a calibrated Dwyer (or equivalent) pressure transducer with a range of 0 to 5 inches sensitivity via 250 feet of tubing to measure the exhaust duct flow rate during both idle periods (no fuel being transferred), and also during fuel transfer periods. Additionally, flow rate was calculated during tank filling using the theoretical amount of air being displaced during fuel transfer into the tank.

Eastmount conducted an initial flow traverse at all traverse points. The pitot tube/thermocouple was then fixed in position at a traverse point that most closely matched the average duct velocity. The pitot tube was periodically removed to be inspected, cleaned if necessary, leak checked, and re-positioned in the duct. At no time during this program did the pitot system develop a leak, become clogged, or become dislodged from its intended position in the duct.

The molecular weight and moisture of the gas in the exhaust duct was assumed to be ambient during normal storage tank off-gassing since the majority of the gas entering and leaving the TTE was ambient air. During vessel transfer operations, Eastmount determined (utilizing a Tedlar bag and calibrated oxygen analyzed), that the oxygen concentration level in the storage tank was essentially ambient, and therefore the molecular weight on ambient air was used in all flow rate calculations.

Volumetric flow rate data was logged on a data acquisition system (DAS) consisting of an Iotech DAQ 56 data logger and a computer. Flow data consisting of velocity pressure and temperature were recorded by the DAS in two-second intervals, and reported in one-minute averages.

4.2.3 VOC HAPS - EPA TO-15

VOC Hazardous air pollutants (HAPS) were determined by collecting a sample in a prepared, pre-evacuated Summa canister with a calibrated flow orifice meter to allow canister filling for 60 minutes. The sample was delivered to the canister via a short length of ¼" OD Teflon tubing and a short ¼" stainless steel probe which was positioned in the duct center using a leak-free Swagelok fitting. A total of six Summa samples were collected during this program – four during normal tank breathing, one during vessel transfer, and one during truck loading.

Maxxam Analytics of Burlington, Ontario conducted the final analysis of the Summa canisters in strict accordance with EPA Method TO-15. Analysis of VOC HAPs were determined by Gas

Chromatography / Mass Spectrometry (GC/MS). The analytes consisted of the standard TO-15 list of VOC HAPs, plus the first 20 tentatively identified compounds (TICs). Results were reported in ppb, ug/M^3, and lb/hr for each compound.

4.2.4 Temporary Total Enclosure (TTE) System – EPA Method 204

A temporary total enclosure (TTE) was constructed around each of the two exhaust vents on Residual Storage Tank No. 3. The purpose of this approach was to capture vapors breathing from the two tank vents, and deliver them to a common sampling location at a velocity that was measurable using EPA Method 2C equipment. Each TTE fully encapsulated each exhaust vent. Each TTE was equipped with a single adjustable natural draft opening (NDO) and an exhaust duct. The exhausts of both TTEs were connected to a common exhaust duct equipped with sampling ports, an adjustable waste gate, and an exhaust fan.

The static pressure of each TTE was measured using a Dwyer Model DM-1123 digital low pressure gauge with a range of -0.5 to 0.5 inches w.c., and a resolution of 0.001 inches. The gauge was located on the side of the TTE. The positive pressure tap was fitted with a flexible Tygon tube that was positioned inside the TTE. The negative pressure tap was left opened to atmosphere, but was protected from the wind using a shield. The static pressure of each TTE was maintained at negative 0.007 inches water column (w.c.) or more negative in order to achieve 100% capture. The static pressure was measured daily, and recorded on the daily check list.

4.2.5 Test Log / Daily Activities

Eastmount maintained a test log consisting of daily equipment checks and calibrations throughout the 30-day test program. The log served to document all testing, calibration and QA/QC activities. As this program occurred over an extended period of time, it was essential to conduct calibrations and other equipment inspections on a daily basis. Daily calibrations and equipment checks were recorded on field data sheets which can be found in Appendices A2 and A3. Please refer to Section 5.2 of this protocol for a complete summary of daily onsite QA/QC activities.

4.3 Description of VOC and Methane Sampling

4.3.1 VOC and Methane Sampling System

What follows is a description of the transportable continuous emissions monitor system used to quantify VOC and methane emissions. The system meets all the specifications of Reference Method 18 and 25A:

- **Probe -** A stainless steel probe was used at the sampling location. The probe was of sufficient length to reach the centroidal area of duct.

- **Calibration Tee** - Stainless steel tee (3/8") located between the probe and the sample line allowed the operator to inject calibration gas through the entire sampling system. Excess calibration gas exits the probe eliminating any potential over pressurization.

- **Filter** - A heated, spun-glass fiber filter contained in a heated sheath was used to remove particulate from the gas stream. The filter was located between the sample probe and sample line. It is designed to remove particulate from the gas stream. The filter was heated to 275°F.

- **Sample Line -** A heated 3/8" OD Teflon sample line was used to transport the sample stream from the test locations to the analyzer. The line was heated to approximately 275°F to prevent condensation of hydrocarbons before reaching the analyzer.

- **System Calibration Line -** A ¼" OD Teflon tube was used to transfer calibration gas from the cylinder to the calibration tee between the probe and filter.

- **Sample Pump** - A leak-free pump (integrated into the VIG analyzer) was used to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. The components of the pump that contact the gas stream are constructed of stainless steel or Teflon. The sample pump was heated to 275°F to prevent condensation.

- **THC Analyzer –** One VIG Model 200 flame ionization analyzer (FIA) was used.

- **Data Acquisition System (DAS) –** The VOC analyzer's response was recorded on a Dell Inspiron 1710 computer working in unison with an Iotech Data Acquisition System. This system was programmed to collect a data point every 2 seconds, and report/save the data in one-minute averages to the Iotech software. This software operates in a Windows environment.

4.3.2 VOC and Methane Sampling Procedures

Both the THC FID and the methane GC were initially calibrated using zero air and low, mid and high propane-in-air calibration gases, certified in accordance with EPA Protocol procedures. The internal GC in the VIG that measured methane was calibrated using zero air and zero, low, mid and high methane-in-air calibration gases certified in accordance with EPA Protocol procedures.

Calibrations were conducted through the entire sample system. A description of the specific procedures is provided below:

- **Zero:** The zero point of the analyzer was determined using a pre-purified cylinder of air. The zero point was analyzed for a minimum of five minutes to monitor drift before sampling commences.
- **High:** The high calibration gas was 80-90% of span. It was introduced to the sample system and the response of the analyzer was adjusted accordingly.
- **Low:** The low calibration gas was 25-35% of span. It was introduced to the sample system and the response of the analyzer was recorded.
- **Mid:** The mid calibration gas was 45-55% of span. It was introduced to the sample system and the response of the analyzer was recorded.

Once the analyzer was calibrated, the system was switched to sample mode and sampling commenced. The response time of the system was determined from the time the gas valve was shut off to the time the response of the FIA is 95% of the steady state sample value. The DAS then recorded the analyzer response throughout the test run. On a daily basis, the sampling system was post-calibrated. The post calibration consisted of delivering zero and a representative upscale calibration point through the entire sampling system and recording the system response. This response was used in conjunction with the initial system calibration in order to determine calibration drift over the test run period. If the analyzer drift was within the 3% of the measurement range, then the data collected between the previous and current calibrations was considered valid. If the analyzer drift was outside 3% of the measurement range, then the data would have been voided, and an entire system recalibration (zero and three upscale points) would have occurred.

4.4 Reference Method Volumetric Flow Determination

In conjunction with VOC monitoring, Eastmount continuously measured volumetric flow in accordance with EPA Methods 1-2C, 40 CFR 60, Appendix A. The following is a description of the individual components that comprised the sampling train.

4.4.1 Volumetric Flow Rate Equipment

Eastmount conduct volumetric flow rate determinations during this test program in accordance with procedures delineated in EPA Methods 1 and 2C, 40 CFR 60, Appendix A. The system components necessary to conduct this testing are detailed below:

- **Pitot Tube -** A small S-type pitot tube (constructed of 3/16" tubing) was used to measure gas velocities. A pitot coefficient of 0.84 was used.
- **Pitot Lines -** The pitot tube was connected to a pressure transducer via a 250-foot, leak-free flow line also equipped with thermocouple wire.
- **Pressure Transducer -** A pressure transducer, manufactured by Apex Instruments, with a range of 0-5" w.c. and a 0.01" w.c. sensitivity, was used to measure the velocity pressure drop.
- **Thermocouple -** A "K" type thermocouple was used to monitor the gas temperature.
- **Static Pressure** - Duct static pressure was measured by rotating the pitot tubes perpendicular to the direction of flow, disconnecting the negative pitot (if positive) and recording the deflection of the manometer.
- **Barometric Pressure -** The barometric pressure was obtained daily from the National Weather Service for the Searsport, ME area.

4.4.2 Volumetric Flow Rate Sampling Procedure

The following describes the procedure used to measure flow rate from the storage tank exhaust duct:

1. Assemble pitot tube, flow line, and pressure transducer. Mark the pitot tube with the appropriate traverse points.
2. Conduct a leak check on the system as follows: (a) blow through the pitot impact opening until at least 7.6 cm (3.0 in.) H_20 velocity head registers on the pressure transducer display, and close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3.0 in.) H_20.
3. Conduct a preliminary traverse of the exhaust duct with the TTE/ID fan system operating normally. Record the velocity pressure and temperature at each location
4. Position the pitot tube/thermocouple at the traverse point that most closely matches the average velocity pressure, and lock it into position.
5. Commence recording flow and temperature data.
6. Inspect, leak check and re-zero the system as required. This procedure was carried out weekly by Eastmount onsite personnel.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

5.1 Overview

Sampling was conducted by trained personnel with extensive experience in Reference Method sampling. All sampling and analysis was conducted in strict accordance with EPA test procedures. The quality control procedures found in the EPA Quality Assurance Handbook for Air Pollution Measurement Systems were adhered to as well.

Eastmount Environmental Services, LLC has established and implements a Quality Management System that conforms to all of the requirements of the ASTM 7036 D - 04 quality standard entitled "Standard Practice for Competence of Air Emission Testing Bodies (AETB)". A copy of the company's AETB Certification Statement is available on request. The company has also developed a Quality Policy Statement confirming management's commitment to undertake its scope of services in full conformance with all aspects of its Quality Management System and the ASTM D7036-04 practice standard. Further, the company has defined a set of Quality Objectives as part of its Quality Policy Statement that serve as the basis for maintaining the highest level of quality in its day-to-day testing and calibration initiatives. This program was carried out in full accordance with the company's Quality Management System.

All of Eastmount's field testing staff are nationally certified as Qualified Stack Testing Individuals (QSTI). Specifically, the Eastmount Project Director for this program is certified in all four groups associated with the QSTI certification program. The QSTI certification is recognized by EPA as the officially designated standard of expert air emissions testing acumen. It confirms that an individual demonstrates the knowledge and ability to carry out source testing and fundamental air quality engineering to the highest standards.

All calculations were conducted in strict accordance with the equations found in the individual Methods. Strict QA/QC protocols were followed during all phases of this project. These protocols included:

- QA objectives for measurement data;
- Data reduction;
- Internal QC;
- Calibration of equipment;
- Corrective action, if necessary; and
- Use of standardized field data sheets.

These specific procedures in addition to Eastmount's usual high standard of quality control will help validate the results obtained in this test program. As the majority of our emissions testing work is done for compliance purposes, strict QC procedures are incorporated into our everyday work performance.

5.2 Daily Onsite QA/QC Activities

The following section describes the onsite QA/QC activities that occurred on a daily basis throughout the program. Eastmount provided training to Sprague personnel to specifically carry out the required daily procedures. All activities were entered onto standardized field data sheets that were used to log equipment checks and calibrations.

5.2.1 VOC Analyzer

The total hydrocarbon analyzer was initially fully calibrated using the procedures defined in Sections 4.3.2 and 5.3.4 of this report. This consisted of first zeroing the analyzer(s) through the entire system with UHP air, spanning the instrument(s) with a high calibration gas of 80-90% of instrument range, and then introducing two additional gases at 45-55% and 25-35% of analyzer range.

On each day of the 30-day sampling period, zero gas and a single upscale gas were introduced to the system to verify that the system calibration was within the tolerance of EPA Method 25A. The system was fully re-calibrated periodically, such as before and after the vessel transfer or after system maintenance. Otherwise, daily post-calibrations were conducted to demonstrate that the system response had not drifted from the initial calibration by more than 3% of the sampling range of the analyzer. A pass/fail range was calculated by Eastmount based on the most recent initial calibration results, allowing the operator to quickly determine the status of the daily calibration.

All calibration data, including the operator name, date/time, calibration gas concentrations, and calibration status (pass/fail) were documented on the daily calibration data sheets that can be found in Appendix A2. A pass/fail range was established on the data sheet to allow the operator to quickly determine the status of the calibration. Calibration data values were entered into a spreadsheet logged on data sheets. Any anomalies (analyzer drift, analyzer recalibration, malfunctions such as analyzer flame-out, etc.) were cited in the log, and were immediately reported to the EPA.

5.2.2 Flow Monitor

The pitot tube and pressure transducer system were inspected on a weekly daily basis. The pitot tube was removed from the exhaust duct and inspected to ensure that the pitot openings were clear and free of condensed oil or other contaminants. The pitot system was leak checked by pressurizing the positive line, sealing it, and observing a steady transducer reading for 15 seconds. The negative line underwent the same leak check procedures under negative pressure. Once leak checking was completed, the pitot system was re-zeroed (if needed), and the pitot was returned to the traverse point of average velocity. Any anomalies (clogged pitot, leak in the system, etc.) were recorded on the test log, and reported to the EPA. During this program, there were no issues regarding pitot leaks, significant zero drift, clogging of the pitot openings, or significant coating of the pitot head.

5.2.3 TTE Pressure

The static pressure of the TTE was checked and recorded in the Test Log on a daily basis. The static pressure needed to be at least negative 0.007 inches w.c. or more negative. If the static pressure of the TTE was found to be less than negative 0.007" w.c., the ID fan waste gate and/or NDO damper(s) were adjusted to achieve the required static pressure. All TTE daily static pressure reading were recorded on the daily test log forms.

5.2.4 Process Data

In addition to test parameters, the following operating parameters were recorded on a daily basis:

- Temperature of the product in the storage tank.
- Percent of capacity of storage tank (where 100% = filled to safe maximum level).

5.3 Volatile Organic Compounds

The following subsections present the Continuous Emissions Monitoring System (CEMS) criteria for VOC that were adhered to throughout the test program:

5.3.1 Leak Check

Prior to the initiation of testing, the reference method VOC system was leak checked from the end of the sampling probe by ensuring that the system vacuum reached the capacity of the sampling pump (~20"Hg) while all rotameters indicated no flow. If a leak was detected, it was traced, fixed and the leak check procedure repeated until successful.

5.3.2 System Response Time

Prior to the initiation of sampling, a reference method VOC system response time was determined. During the test program, the system was allowed to sample a minimum of 2.0 times the response time prior to the initiation of any sampling runs.

5.3.3 Calibration Gases

All calibration gases utilized were prepared according to EPA Protocol standards.

5.3.4 Calibration Criteria

- **Calibration Error** – As an initial analyzer calibration procedure, or as necessary following a daily calibration drift check, a calibration error test was conducted for each analyzer channel for the low and mid level gases, as follows. Following instrument calibration (zero and span), the mid and low range calibration gases were injected and the instrument responses recorded. From these values calibration error was calculated for low and mid level gases in accordance with the formula presented below. The maximum allowable calibration error is 5% of the expected value for both the low and mid level gases. If this limit was not achieved, corrective action was taken and the procedure repeated until successful**.**

$$CalibrationError = \frac{(Concentration_{\mathrm{Re}\,sponse} - Concentration_{value})}{InstrumentSpan} \times 100$$

- **Calibration Drift** – On a daily basis and following the most recent full system calibration error check, a calibration drift test was conducted using zero and a single upscale gases for each analyzer channel. The zero and upscale calibration gases were injected and the instrument responses recorded. From these values, calibration drift was calculated in accordance with the formula presented below. The maximum allowable calibration drift is 3% of instrument span. If this limit was not achieved, the data was considered invalid, corrective action was taken, and full system calibration conducted.

$$Drift = \left| \ CalibrationError_{final} - CalibrationError_{iniital} \ \right| \times 100$$

5.4 Volumetric Flow Equipment Calibrations

Eastmount's pitot tubes and thermocouples are maintained in accordance with specifications set forth in EPA "Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III Stationary Source Specific Methods" and with manufacturer's suggested procedures. A summary is presented below:

- **Thermocouples** - All type K thermocouples are calibrated against ASTM mercury-in-glass thermometers at three points that bracket the operating temperature of the specific thermocouple. The typical calibration points are an ice bath, ambient air, boiling water, and hot oil.
- **Pitot Tubes** - All Type "S" stainless steel pitot tubes are designed to meet the dimensional criteria set forth in Method 2, therefore a coefficient of 0.84 (Type "S") is used.
- **Pressure Transducers** – All pressure transducers used in this program were calibrated against an inclined manometer at four pressure points.